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IMPLEMENTATION OF FLU (INFLUENZA) VACCINATION INTO ARMENIAN ARMED FORCES PRE-EMPTIVE VACCINATION PLAN

December 2016

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ABSTRACT

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I. INTRODUCTION

Implementation of Flu (Influenza) vaccination into Armenian Armed Forces pre-emptive vaccination plan is the project subject under consideration. In other word, this is “ex ante” cost benefit analysis to assist Armenian Military authorities in the decision about how recourses should be allocated (Boardman, Greenberg, Vining, & Weimer, 2011). In today’s environment with limited resources, the Army, especially in the country such as Republic of Armenia with its low economic development, has to exercise judicious management and control of every dollar it spends (Office of the Deputy Assistant Secretary of the Army, 2013). The purpose of the project is to acknowledge the influence of influenza vaccinations on Armenian Armed Forces personnel readiness and to support decision makers. This purpose is supported by the analysis of flu vaccination plan implementation in Armed Forces of Armenia. The costs to impotent the flu vaccination plan and benefits of preemptive vaccination are compared and examined in order to draw the conclusions related to the topic.

A. RESEARCH QUESTIONS

(1) Primary Research Question

What are the costs and possible benefits to Armenian Ministry of Defense in implementation of flu vaccination into Armenian Armed Forces personnel pre-emptive vaccination plan?

(2) Secondary Research Question

What is the current cost of not having flu vaccination plan?

B. BENEFITS AND LIMITATIONS OF RESEARCH

The underlying research has several implications for Armenian Armed Forces and other researchers who want to explore this subject. Cost benefit analysis will enable Armenian Armed Forces, as a primary stakeholder, to plan and implement the flu vaccination. Flu vaccination plan implementation is of great importance as numbers of cases in the past are recorded. Military Medical Department of Armenian Armed Forces provided morbidity and financial data for the project. It includes registered outpatient and inpatient flu cases from 2006 to 2014, complications and treatment's cost estimates. Cost for acquisition of flu vaccine provided by acquisition department of Ministry of Defense. Army can use this research in order to examine the importance and application of flu vaccination. In addition to the specific benefit of this research for Armenian Army, there are some general benefits associated with this research as well. Other researchers in this field can use it for theoretical foundation of research. This research will open gates for new researches in this regard. The framework developed in this research work will act as guidance of other studies in similar context. There are some limitations of this project as well. This project does not consider payroll and training cost for personnel who will be involved in the vaccination's implementation program. It also does not consider distribution of flu vaccine to the military installations, because distribution mechanism has been already developed and Military Medical Service have required necessities such as portable freezers, to transport the vaccine. These limitations will hinder the prosperous use of this study. This study is related to flu vaccination implementation in Armenian Army so the study is specific and generalization is an area of consideration. The generalizability of flu vaccination implementation study is not apparent as the generalizability requires general context for study.

C. ORGANIZATION

This study is organized in few headings. It starts with the overall introduction of the research. Detailed methodology follows the introduction of the study. The methodology section details the process which is adopted to complete the analysis of the flu vaccination implementation in Armenian Armed Forces. CBA analysis is completed after the creation of data from recognized source which is Military Medical Department of Armenian AF. CBA analysis is performed for ascertainment of actual costs and benefits associated with the flue vaccination plan implementation in the Armenian Armed Forces.

D. METHODOLOGY

There is a clear and intended objective behind the methodology laid for this project. The objective of intended methodology is the establishment of valid cost-estimation model (Wilson, Barnard, Summers, Shanks, & Baker, 2012); this cost estimation model will be prepared on the basis of historical data for further evaluation of cost benefit analysis of the project. The reason behind the establishment of aforementioned cost model for the analysis of project on the basis of CBA is due to the fact of ascertaining costs borne by the Armenian Armed Forces in the last 9 years in context of influenza cases. This methodology to ascertain costs of the influenza cases in both inpatient and outpatient scenarios is beneficial for completion of CBA analysis on later stages. The derived costs from the historical data will be averaged for 9 years in order to determine the spending's of Armed Forces on an average level per year. These averaging amounts are helpful for CBA analysis. The future benefits of the Armenian Armed Forces are dependent on redemption of these costs with the implementation of flu vaccination plan (Wilson et al., 2012).

E. SUMMARY

This study focuses its attention on the cost and benefit analysis of flu vaccination plan implementation in the Armenian Armed Forces. This specific project evaluates the costs and benefits of flu vaccination plan in order to enhance the readiness of the Armenian Armed Forces personnel. Flu has its implications on the readiness of Armenian Armed Forces personnel which hinders the progress and capabilities of soldiers. In this project CBA analysis is performed for flu vaccination plan implementation in the Armenian Armed Forces. Numbers of variables have been considered for analysis of costs and benefits of flu vaccination plan implementation. The cost model is created as part of project methodology; the reason behind the establishment of aforementioned cost model for the analysis of project on the basis of cost benefit analysis is due to the fact of ascertaining costs borne by the Armenian Armed Forces in the last 9 years in context of influenza cases. This is the brief narrative of work that is performed in the project.

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II. BACKGROUND

A. ARMENIAN ARMED FORCES

On 21 September, 1991, Armenia declared its independence from Soviet Union. After several months in 28 January, 1992, the Armenian Armed Forces was founded, which are staffed by persons undergoing mandatory military service and contractual military service. In accordance with the Law of the Republic of Armenia “On Conscription” the mandatory military service is the military service of private corps, commissioned staff called-up to the armed forces and other troops, and the military service of cadets studying in military-educational institutions. Contractual military service described as the voluntary military service of private corps, non-commissioned and commissioned staff, including those having graduated from military-educational institutions, and women in the armed forces and other troops. Citizens recruited into contractual military service enter into a written contract with the Ministry of Defense (Law on Conscription of the Republic of Armenia, 1998). Same Law states that male draftees aged between 18 and 27 and reserve officers of the first group, recognized fitting for military service in peace time according to their state of health, are called up to military service (Law on Conscription of the Republic of Armenia, 1998). Today, Armenian Armed Forces comprises two services: the Army, and the Air Force and Air Defense with 48,280 personnel, including 21,680 professional and 26,600 conscripts. (Department of Staff of the Ministry of Defense of the Republic of Armenia, 2015). Five Army Corps are core structure of Armed Forces located in different parts of country. According to annual report of the Department of Staff of the Ministry of Defense demographic statistics as of December 2015 are follows; 43150 male and 4700 female: 29690 are from 18 to 30 years old, 6735 are from 30 to 40, 7135 are from 40 to50, and 4290 are 50 and above (Department of Staff of the Ministry of Defense of the Republic of Armenia, 2015).

B. MILITARY MEDICAL SERVICE OF ARMENIAN ARMED FORCES

The military medical service of the Armed Forces of the Republic of Armenia consists of the Military Medical Department, Central Clinical Military Hospital, Central Military Policlinic, military medical regional hospitals, and medical points in the military units (Ministry of Defense of the Republic of Armenia, 2013; Medical Corps International Forum, 2015). The military medical service of the Armed Forces of the Republic of Armenia is led by the Military Medical Department. It is a strategic body under the direct control of the Deputy Chief of General Staff for logistic support responsible for organizing all medical operational tasks throughout all institutions placed under the authority of the Ministry of Defense and General Staff. It is responsible for "medical and sanitary control of the Armenian Military; control of health, nutrition and sanitary – epidemiological conditions of the units, medical examination of all Armed Forces personnel (twice a year), providing medical care, treatment and rehabilitation to servicemen and all entitled personnel" (Ministry of Defense of the Republic of Armenia, 2013; Medical Corps International Forum, 2015). Central Clinical Military Hospital located in Yerevan, capital of the Republic of Armenia. It is the 350 bed hospital which provides specialized and qualified medical care—role 3 and 4. Five regional hospitals (each with 80 bed capacity) located in accordance with five Army Corps and they provide qualified medical care—role 2. Every military unit has a medical point headed by general practitioner to provide partial qualified and first medical care - role 1. According to the size of military unit beds at the medical points vary from 5 to 15, where patient may be held for at least seven days to receive first care and if necessary to prepare for farther evacuation (Ministry of Defense of the Republic of Armenia, 2013).

C. FLU MORBIDITY BACKGROUND

Projects related to the study of diseases and vaccination plans in the Armed Forces of Armenia have become common practice. In the last decade, it has been observed that number of steps have been taken by Military Medical service and Ministry of Health in the Armenia in order to vaccinate Armed Forces soldiers against various diseases. They have countered some diseases with preemptive measures but failed to concentrate on influenza as serious threat to the readiness of Armenian military. It is not useless to mention geographic location and weather conditions. Being mainly mountainous country Armenia is experiencing abrupt changes in weather. During the fall and winter the weather is cold and dry and the daytime and nighttime temperature varies drastically. The cold and dry air provides optimal conditions for influenza virus to replicate and spread. While flu viruses can be detected all year-round, the autumn and winter are most common time for flu viruses to spread (Centers for Disease Control and Prevention, n.d.). It activity peaks between November and March. Another soil for rapid spread of flu virus is living conditions in military units; there are still old barracks that hard to ventilate and density of solders is high. Thus, soldiers are often exposed to circumstances and conditions where they are more likely to catch virus causing flu (Military Medical Department, 2014). It is a contagious disease and can infect numerous military personnel. The Armenian army has borne massive costs in context of treatment of influenza patients. The costs of treatment are considerable as well. The Armenian army has not only borne direct costs from treating the afflicted, but also experiences indirect costs as well. Absenteeism due to disease is a significant cost for the army. It seems from the cases of influenza in the past that Armenian army lacks an appropriate vaccination plan for flu. Many of reasons can be attributed to this lack of plan. A cost benefit analysis of implementing a flu vaccination plan may help officials in the Armenian military to understand the implications of influenza on soldiers and military as a whole.

In 2005 Armenian Armed Forces adopted a new vaccination plan for recruiters: measles-mumps-rubella (MMR combined vaccine); diphtheria-tetanus-pertussis; (DTaP combined immunization); hepatitis A; pneumococcal; and meningococcal vaccinations have been administrated (Ministry of Defense of the Republic of Armenia, 2005). As a result, the Military Medical Service of Armenian Armed Forces documented a dramatic decrease of related diseases. Some of them, such as diphtheria, tetanus, pertussis, mumps, and rubella have been completely eliminated within a few years (Military Medical Department, 2011). However, as it was before a new vaccination plan and after it, the prevention of flu remains as a main challenge for medical personnel as the figures of last

9 years in case of influenza in Armenian Armed Forces are alarming (Military Medical Department, 2014). There are considerable numbers of 2-year conscript servicemen and officers in Armenian Armed Forces who have been victims of flu (Abrahamyan, 2016). It varies from 21,000 (lowest in 2011) to 36,000 (highest in 2013) cases annually (Military Medical Department, 2014). This apparent threat in the Armenian Army requires certain measures in form of vaccination plan for complete eradication or mitigation of influenza cases.

D. SUMMARY

Historically, number of studies and vaccinations are performed in Armenian Army in order to eradicate any probable disease that can impact the performance of troops. Although the efforts were made in Armenian Armed Forces for treatment of various diseases, flu has always been an important issue for Armed Forces (Military Medical Department, 2011).With this background, this study is aimed to present flu vaccination implementation plan in Armenian Army.

III. LITERATURE REVIEW

Interesting enough, reviewing pertinent literature I find out that there is an absence of vast literature in context of flu vaccination implementation plan studies in Armed Forces, instead there are a numerous studies how vaccination affects population as whole. In this light, I have divided my literature review based on different perspectives in order to emphasize its importance in whole and particularly how flu vaccination affects armed forces personnel readiness.

A. COST-BENEFIT ANALYSIS OF FLU VACCINATION AND ITS EFFECTS ON POPULATION

Flu is always highly prevalent in the Armenian Armed Forces personnel morbidity (how often disease occurs in specific area) ranking. The morbidity level of flu in Armed Forces differs from year to year. It varies from 21,000 (lowest in 2011) to 36,000 (highest in 2013) cases annually (Military Medical Department, 2014). Some studies have shown that immunization may have suspicious efficiency; however, even with low efficiency, flu vaccination is likely beneficial for a country such as Armenia, with its low economic and public health care development. There are numerous studies have been done in favor of flu vaccination.

Influenza is known largely to be an infectious viral illness that can be prevented. However, its treatment and complications consume substantial resources which can be put to use for other important healthcare resources. The cost of treating influenza borne by the government can be put to use more effectively and efficiently for its prevention. Furthermore, apart from just preventing and treating influenza, there are other costs involved that are considered to be greater than the cost of preventing and treating it. Influenza is known to be a seasonal endemic disease as a result of the high level of transmission and infection that takes place in the months that are very cold in temperate climates. The occurrence of influenza is also high all through the year in subtropical and tropical climates (Smith et al., 2006). According to Smith et al., the complications as a result of influenza experienced by people with kidney problems, asthma, heart conditions, weak immune, lung conditions, nursing home residents, and people over the age of sixty five (65), irrespective of the status of their health can greatly pose a threat to life.

1. Studies on Cost-Benefit Analysis in Developed Countries

In this light, many developed countries have instituted yearly vaccination programs for populations considered to be at high risk (Tay-Teo & Carter, 2006). However, the risk of complications in working adults between the ages of eighteen (18) and sixty four (64) years is considered to be lower. While the burden posed by influenza in working population between the ages of 18 and 64 may be considered to be small with many of the symptoms only lasting for about 3 days, the malaise and cough that are connected to influenza can remain prevalent for several weeks (Demicheli, Rivetti, & Deeks, 2004). Additionally, it is noteworthy that 1.2 million of the population believed to be working adults that are healthy have basic conditions capable of leading to life threatening and even more severe consequences once they catch the disease (Thompson et al., 2004)

Yearly, a substantial burden of disease around the globe is associated with influenza viruses. Estimated data have shown that in countries with higher income, infections caused by seasonal influenza occur in roughly 10 to 20 percent of the population of the world and can result in over 3 million cases of serious illnesses and diseases and between 250,000 and 500,000 cases of deaths around the globe (WHO, 2003). Ever since the influenza H5N1 emerged in 2003, there has been an increase in the number and quality of surveillance data available around the world due to the increase in the number of investments into the research and surveillance of influenza (Radin et al., 2012). This buildup of data has immensely helped to emphasize on the fact that the circulation of influenza is global, and establish the fact that burden as a result of influenza in some settings may be much higher than the burden experienced in temperate regions with higher income because of some factors, including specific co-morbidities like HIV, or due to a lack of access to health care (Dawood et al., 2012; Cohen et al., 2010).

Recently, it has been suggested by the World Health Organization's Strategic Advisory Group of Experts (SAGE) that every country should encourage vaccination to at-risk population, including the elderly, young children, and others with causal conditions, given particular preference to who are pregnant in order to preserve the lives of the mother and the child (Partridge & Kieny, 2013). Worldwide increases in the capacity of manufacturing, both in diversity of vaccine producing nations and in the number of doses, may perhaps permit many countries that formerly had modest or no vaccination experience for influenza to critically put into consideration its introduction into seasonal programs for immunization (Robero-Alvarez, Kurtis, Danovaro-Holliday, Ruiz-Matus, & Andrus, 2009).

For example, influenza vaccine has been added to the Pan American Health Organization's (PAHO) list of vaccines made available at lower prices to nation that fall under the PAHO region (Robero-Alvarez et al., 2009), and other countries such as India, Thailand, and Brazil are beginning to embark on the development of domestic seasonal vaccine for influenza (Plianbangchang, 2010). For several nations that do not have the capacity to introduce vaccines on a broad scale, protecting the mother and child through maternal influenza immunization may become the initial step and there is every tendency that this could be subsidized in the near future via Global Alliance for Vaccines and Immunization mechanisms (Peasah, Azziz-Baumgartner, Breese, Meltzer, & Widdowson, 2013).

One very important driver of vaccine policy is the amount of money involved in getting the vaccine for influenza, the way it's been delivered, and the economic effect of influenza. Many countries that have over the years developed programs for influenza vaccination have done so many economic valuation studies aimed at assessing the number of admissions and visits, "quality adjusted life years lost, cost-of-illness, cost-effectiveness, cost–benefit analysis, and loss productivity, and these data point to substantial economic burden (Molinari et al., 2007; Peasah et al., 2013). In the United States, the yearly cost of seasonal influenza was estimated to be between 71 billion U.S. dollars and 167 billion U.S. dollars from the perspective of the society (Molinari et al. 2007). As the production capacity of vaccines for influenza increases around the globe and many countries are now considering the introduction of more than one SAGE recommended group, studies on cost-effectiveness and cost-benefit analysis will be very important when making decisions (Peasah et al., 2013).

Peasah et al. (2013), who carried out a study aimed at identifying the gaps in cost and cost effectiveness analysis, discovered that the costs of treating or preventing influenza can be viewed from two perspectives: health care and societal perspective. According to the authors the costs of treating and preventing influenza from the perspective of healthcare consider direct medical cost (particularly hospitalizations), which is a function of the number of visits. On the other hand, when viewed from a societal point of view takes into consideration direct medical costs, “direct medical costs, the cost of productivity losses and number-of-years loss” (Peasah et al., 2013). Indirect cost such as loss productivity can also be considered a crucial cost driver, particularly in Europe, where reports suggest that indirect cost is 10 times higher than direct medical cost. However, in Asian countries such as Thailand and Hong Kong, indirect costs were found to be lesser and even sometimes less than half of the direct medical cost (Peasah et al., 2013). Despite cultural differences, low absenteeism and disparities in the severity of the disease was found to be the underlying factors for the data from Hong Kong (Fitzner, Shortridge, McGhee, & Hedley, 2001)

2. Cost-Benefit Analysis for At-risk Population and Population Aged 18–64 Years

According to Breteler, Tam, Jit, Ket, & De Boer (2013), vaccines for influenza have been recommended for people considered to be at risk for very serious infection in low and middle income countries, even though there is limited knowledge based on evidence of their efficacy and effectiveness in these countries. In this light, the authors aimed to provide evidence for the efficacy and effectiveness of treatments for influenza in low and middle income countries. The results of this study revealed that the effectiveness and efficacy of seasonal vaccination for influenza as against influenza confirmed in the laboratory showed “(pooled efficacy 72% (95%CI: 65–77) and 81% (95%CI: 69–89), for one and two years follow-up, respectively) and in the elderly (pooled efficacy 43% (95%CI: 25–56) and 58% (95%CI: 23–78), for live attenuated and inactivated vaccine respectively)” (Breteler et al., 2013). It was also discovered that influenza vaccines that were inactivated were effective against cardiovascular outcomes in patients found to have coronary syndromes (p. 5174). The authors concluded by asserting that vaccinations for influenza administered seasonally can provide children, adults (including the elderly), and patients can provide protection against coronary syndromes in middle income countries.

Some researchers claim that targeting all age group in times of vaccination, especially those vaccination that are regular, results to higher coverage of at risk population, and in most cases almost 30% higher in terms of individual at risk to normal individuals without any risk (Tacken et al., 2002; Meier, Napalkov, Wegmuller, Jefferson, & Jick, 2000; Centers for Disease Control and Prevention, 2003). Influenza vaccination is presently suggested for adults with high-risk severe conditions and additionally all individuals aged 65 years or more in Italy and France, whereas in Brazil and Germany, it is recommended for individuals aged 60 years or more.

Vaccination is recommended by the Advisory Committee on Immunization Practices (ACIP) for people between the ages of 50 to 64 years, however, they clearly points out that there are not enough studies on cost-effectiveness for this age group (Harper, Fukuda, Uyeki, Cox, & Bridges, 2004). This study further investigated on the cost-effectiveness, health gains, and budgetary impact that can probably result from increasing vaccination coverage above the levels that the current policies achieved. This was done by the researchers to provide decision makers information as to whether or not to embark on influenza vaccination. The result of this study suggests that it is beneficial to carry out a seasonal vaccination for people between the ages of 50 to 64 years, placing more emphasis on those that are considered the at-risk population.

Vaccination of grown-ups below the age of 65 has been discovered to reduce indirect and direct costs from absenteeism from work in two studies conducted in the United States (Nichol, 2001; Nichol, Mallon, & Mendelman, 2003), even though the outcomes of this study were not similar to the ones in the third study (Meltzer, Neuzil, Griffin, & Fukuda, 2005). Meltzer et al. (2005) however asserted that vaccinating children against influenza would be cost-saving, with infants with medical condition having the highest cost savings.

Although influenza vaccination in children may involve a great deal of cost, studies have found that vaccination in children is either cost-beneficial or cost-saving (Cohen & Nettleman, 2000; Dayan, Nguyen, Debbaq, Gomez, & Wood, 2001; Luce et al., 2001; White, Lavoie, & Nettleman, 1999). Prosser et al. (2006) in his comparative study of the economics of violating people 18 years of age with LAIV or TIV found comparable cost savings and cost benefits between the both vaccines, but for older people, the cost increased as compared to the younger ones. Furthermore, a cost-benefit analysis of vaccination programs targeted at women who are pregnant showed that it is cost-beneficial and effective (Jit et al., 2010; Myers, Misurski, & Swamy, 2011). Also, influenza vaccination of pregnant women who have extra comorbidities was also discovered to be cost-saving (Skedgel, Langley, MacDonald, Scott, & McNeil, 2011)

Influenza vaccination has been discovered to be a very cost-effective and efficacious tool for reducing mortality and morbidity as a result of influenza in the elderly (Vu, Farish, Jenkins, & Kelly, 2002; Fedson, Houck, & Bratzler, 2000; Aballea et al., 2007). Vaccinating health working adults below the age of 65 against influenza can help to reduce the rate of lost workdays, influenza-related illnesses, and visits by a physician, and can also prevent complications and illness among older adults (Bridges et al., 2000; Ohmit et al., 2006; Nichol, Nordin, Nelson, Mullooly, & Hak, 2007). The effect of influenza infection on the economy is substantial. It was discovered by Molinari et al. (2007) that the amount of money used to curb a severe case of influenza pandemic is estimated to be around 87.1 billion dollars. A lot of these deaths, illness, and economic cost associated with influenza can be averted with higher levels of influenza vaccination coverage (Lu, Bridges, Euler, & Singleton, 2008).

Additionally, several researchers also recommended that people between the ages of 50 and 64 be vaccinated due to the fact that a great number of people between this age group have a greater risk of complication arising from having one or more medical ailments (Egede & Zheng, 2003; Singleton, Wortley, & Lu, 2004; Lu, Singleton, Rangel, Wortley & Bridges, 2005). In spite of the presence of effective and safe vaccine and established recommendations to make available influenza vaccination to targeted population on a yearly basis, it has been discovered that the level of vaccination is suboptimal (Egede & Zheng, 2003; Singleton et al., 2004; Lu, Singleton, Rangel, Wortley & Bridges, 2005).

Several researchers have assessed influenza's economic impact on target populations. Results from these studies suggests that cost related to influenza includes indirect cost such as loss of production in addition to the cost of acquiring and administering the vaccine accounts for up to 90% of all costs incurred from influenza (Gasparini et al. 2002; Nichol et al., 2003). Results from this research suggest that there are several benefits of influenza vaccination, which, when critically viewed, outweighs the cost of influenza vaccination. One notable benefit from influenza vaccination is the reduction of absence from work, and the duration of absence. According to the authors, this benefit, therefore leads to a reduction of indirect costs (Gasparini et al. 2002; Nichol et al. 2003). Even though the direct cost of influenza vaccination may be high, the net economic benefit cannot be overemphasized. According to Colombo, Ferro, Vinci, Zordan, & Serra (2006), vaccine cost is only but a small part of the total cost when talking about an influenza prevention program, the cost of time administrating the receiving the influenza vaccination is even more significant. Results from the latter study by Colombo et al. (2006) found that for each employee, net savings from early vaccination against influenza is about 55 Euros; while benefit per employee (reduced costs as a result of reduced absenteeism) is 72.62 Euros. In a case where there was no evidence of any benefit, the authors suggested that such case was linked to short sick leave duration, low influenza incidence rate, or very high cost of vaccination (Colombo et al., 2006).

Cost benefits mostly results from savings from indirect cost (lost production, absenteeism losses) (Postma et al., 2002). In any vaccination program, indirect costs should be given the greatest consideration, because when curbed, are responsible for the benefits of the program (Akazawa, Sindelar, & Paltiel, 2003). Research conducted by Das Gupta & Guest (2002) and Lee et al. (2002) found great benefit of influenza vaccination program even where the rate of influenza among the workforce was very low (2%). It was also discovered that administering influenza vaccine to healthy workers between the age of 18 and 50 years in different settings is very much cost-effective at any point in the influenza season. The result of this study was also confirmed by Demicheli et al. (2000) and Postma et al. (2002) who carried out a randomized, double blind, placebo controlled study on healthy adult workers. A report from the American Center for Disease Control and Prevention confirmed that the benefit of administering influenza vaccine to healthy people below the age of 65 is highest when the chosen vaccine strain matches the strain accountable for the outbreak of the disease in that particular year. According to Nichol et al. (2003), in order to financially break even, the use of economic modelling has been adopted to specify the pricing of a new, nasal delivery system for an influenza vaccine.

The benefit derived from administering influenza vaccines to people or from implementing a vaccination program extends even to individuals that are not yet vaccinated, as they become less likely to contract the disease, which can also be beneficial to those that promote the program. This can also lower the rate of new cases of influenza (Colombo et al., 2006). As the number of people who are vaccinated increases, there is a reduction in the number of people who will become ill and also in the number of people who will be infected from others. In epidemiology, this is known as herd immunity (Webster, 2000; Brisson & Edmunds, 2003), and in economics, it is regarded as “positive externalities” (Schnoor, 2003). However, it is very difficult to measure this factor; nevertheless, it is a very important effect of early influenza vaccination that could further lead to other benefits.

3. Cost-Benefit Analysis of Influenza on Population Aged 65 Years and above

There are so many health benefits associated with influenza vaccination for individuals of any age. Several studies have repetitively shown that vaccinating people aged 65 years and above against influenza is greatly economically beneficial (Gross, Hermogenes, Sacks, Lau, & Levandowski, 1995). However, administering influenza vaccine to adults below the age of 65 years may not cost-effective from a societal point of view. A study carried out in Minnesota on healthy working adults in the course of the influenza season of 1994–1995 established that for each vaccinated person, there was a net societal benefit of 46.85 U.S. dollars and also found a reduction in URI (Upper Respiratory Infections) by 35% (Nichol et al., 1995). The rate of influenza infection and efficacy of vaccine estimates were unavailable due to the fact that there were no conducted confirmatory diagnostic laboratory tests. However, works from other researchers have found results dissimilar to the results of this study, and reviews have come up with a conclusion that influenza vaccination of fit adults in less likely to lead to any net cost-saving from a society point of view (Demicheli et al., 2000).

Irrespective of the method used for gathering information for analysis, most of the cost-benefit analysis of influenza vaccine in adults has proved that vaccination in adults is cost effective. Methodical reviews of cost-benefit analyses, among adult population proved that vaccination was cost saving and cost-effective (Postma, Baltussen, Palache, & Wilschut, 2006; de Waure et al., 2012), even though there was difficulty in comparing the studies due to various types of methodology being used. Nonetheless, vaccinating adults over the age of 65 was discovered to always result to cost-effectiveness and cost-savings from a societal point of view (Nichol, Wuorenma, & von Sternberg, 1998; Mullooly et al., 1994) and from the viewpoint of health programs (Maciosek, Solberg, Coffield, Edwards, & Goodman, 2006).

It is recommended that people at risk for complication resulting from influenza are vaccinated with influenza vaccination, not excluding people 65 years of age and older, younger adults having severe illnesses such as chronic obstructive pulmonary disease, kidney failure, chronic heart conditions, cancer, asthma, diabetes, and women expecting pregnancy at some point in the influenza season (Lu et al., 2008). It is also recommended that people who are capable of transmitting influenza to house contacts and health care workers should also take the influenza vaccine (Centers for Disease Control and Prevention, n.d.).

4. Cost-Benefit Analysis of Postpartum Influenza Vaccination

Ding, Zangwill, Hay, & Yeh (2012) carried out a cost-benefit analysis of influenza vaccination to help them discover the economic benefits linked with postpartum influenza vaccination in the hospital. According to the authors, the decision was made from a society and a third party perspective. Using a one-way and two-way sensitivity analysis, the authors discovered that from the perspective of the society, the projected cost for a vaccinated mother and a mother who is not vaccinated were $328.45 and $341.02 respectively (Ding et al., 2012). In this light, the projected net benefit is $12.57 for every mother who is vaccinated. Depending on the rate of vaccination coverage, the projected savings were from the range of $3.69 to $14.75 million. The authors suggested that the strategy they employed in their study will be cost-beneficial, all things being equal, if the rate of maternal influenza attack is above 2.8%, the efficacy of the influenza vaccine is above 4.7%, or if the cost of purchasing and administration for each dose are below $32.78 (Ding et al., 2012). On the other hand, when viewed from the perspective of a third party, the strategy employed in the study will not produce net savings. In conclusion, the authors suggested that influenza vaccination after birth is a cost-effective for preventing influenza in mothers and their babies from the perspective of the society (Ding et al., 2012).

Parlevliet, De Borgie, Frijstein, & Guchelaar (2002) in their study aimed at determining if influenza vaccination in the University of Amsterdam Academic Medical Centre in the Netherlands can result in an economic benefit by ensuring that the loss in productivity that is connected to the outbreak of influenza disease among its employees is avoided. The authors applied a cost-benefit model that was newly developed and viewed from the perspective of an employer using sensitivity analyses. Results from this study showed that there is a net benefit from all the scenarios that were put into consideration: 460,000 Euros, 120,000 Euros, and 180,000 Euros for the vaccination promotion, baseline, and scenarios that were influenza-persistent, respectively. The rate of vaccination compliance was seen to be the factor that had the highest effect on the net benefits. The authors concluded by stating that it is very beneficial when compared to the cost, to perform an influenza vaccination in any institution that has the same characteristics as the Academic Medical Centre. The result of this study suggests that there are greater economic benefits in vaccinating medical residents than performing vaccination of other personnel.

5. Impact of Location on Cost-Benefit Analysis of Adults

Cost-effectiveness and benefit can also vary by location of vaccination. However, it was discovered that the estimated cost of vaccination was lower in nonmedical settings like pharmacies when compared to medical setting such as doctors' offices (Prosser et al., 2008), and when influenza vaccination is administered early in the influenza season, cost-effectiveness and benefit is maximized, as this can help in minimizing the probability of infections (Myers, Misurski, & Swamy, 2011). Almost the entire cost-effectivness analysis have focused on countries with high income, making it impossible to apply the result in countries with low to middle income, however some researchers have analyzed the economic benefits of giving the flu vaccination to workers in the healthcare section in Thailand and Columbia (Apisarnthanarak, Uyeki, Puthavathana, Kitphati, & Mundy, 2010; Chicaiza-Becerra, Garcia-Molina, Ballesteros, Gamboa, & Ricardo Vega, 2008). The studies by Apisarnthanarak et al. (2010) and Chicaiza-Becerra et al. (2008) showed that cost-effectiveness can be achieved in vaccinating healthcare workers who are at high risk of contracting cancer in Colombia, and in Thailand, cost-effectiveness was achieved by the use of a combined package, which included awareness campaigns, anti-viral access, and vaccination.

6. Cost-Benefit Analysis of Influenza Vaccination and Pneumococcal Vaccination

In a bid to estimate the social benefits and costs of influenza vaccination of elderly people, Cai, Uchiyama, Yanagisawa, & Kamae (2006) used three strategies for vaccinating 100,000 elderly people: the administration of only influenza vaccine; not vaccinating at all; and combining pneumococcal vaccines with influenza vaccines. Using the real situation, it is most probable that a patient who is administered pneumococcal vaccines has previously been administered influenza vaccine. Going with such real situation, the authors did not include an approach of administering only pneumococcal vaccines in their study. The result of the study conducted by Cai et al. (2006) suggested that it is very important that the first step that Japan should take at this point is to consider the cost-effectiveness of combining the vaccination for pneumonia and influenza, and also reach an agreement for funds allocation to begin the program. According to the authors, it is only when this is achieved that one can begin to find out ways to encourage and promote the elderly people to take the vaccines (Cai et al., 2006). The result of this study found the third strategy proves to be costlier than the first strategy. However, the cost-effectiveness and benefit derived from the third strategy is greater than that derived from the first strategy in spite of the high cost required for the implementation of the third strategy. The authors further stated that the cost of health care associated with pneumonia and influenza for the studied population will in the future be more challenging and would definitely require an efficient and cost-effective approach. The authors concluded by asserting that combining pneumococcal vaccines and influenza should be the chosen strategy for the elderly population, as this can be very beneficial to public health.

Ament, Baltussen, Duru, Rigaud-Bully, de Graeve and Ortqvist (2000), reveals in their study that; vaccination against pneumococcal and influenza was cost effective if the vaccination was carried out using either of only the pneumococcal vaccine or simultaneously with the influenza vaccine. This study was carried out, putting in consideration, people of between the age grade of ≥ 65 years in five western European countries comprising of France, Belgium, Spain, Sweden and Scotland (Ament et al., 2000). And, according to Allsup, Gosney, Haycox, and Regan (2003) who cited the work of Fletcher, Tunnicliffe, Hammond, Roberts, and Ayres (1997), administering both pneumococcal and influenza vaccine simultaneously is therefore a safe practice as there is no increase in the “frequency of systematic side effects” (Allsup et al., 2003). Many of the diverse researches carried out before now have shown that, there are positive results obtained from the vaccination of persons who have been institutionalized, however, these individuals were also uncontrolled, non-randomized and observational designs, hence, endorsing the idea of introducing the bias to the scope of the study (Allsup et al., 2003).

7. Cost-Benefit Analysis of Influenza on Healthy Working Adults

The study conducted by Postma et al. (2002) and Nichol (2003) is also consistent with the results of most international studies that influenza vaccination is most probable to be cost-saving or cost effective, or beneficial in working adults who are healthy. The vaccine for live attenuated, intranasal, trivalent influenza virus is clinically safe and efficient in working adults that are healthy (Nichol et al., 2003). Nonetheless, there is still uncertainty in the latent economic benefits derived from vaccinating the aforementioned population. In this light, the authors carried out a cost-benefit analysis of vaccinating healthy working adults against influenza using clinical data obtained from a trail of live attenuated, intranasal, trivalent influenza virus vaccine in strong working adults (Nichol et al., 2003).

According to the authors, this analysis was based on the outcome of a randomized, multi-center, double blind, placebo controlled trial aimed at assessing the clinical efficiency of live attenuated, intranasal, trivalent influenza virus vaccine in physically fit working adults. Outcomes such as number of days absent from work, days worked with reduced effectiveness, and days that needed a healthcare provider’s visit as a result of one or more of the named symptoms: runny nose, weakness, chills, muscle aches, cough, headaches, sore throat, and fever (Nichol et al., 2003). The results from this study involving 4,561 participants showed that the live attenuated, intranasal, trivalent influenza virus vaccine reduced work loss as a result of symptoms of illness by 18%, days worked with reduced effectiveness by 18%, and days that needed a healthcare provider’s visit by 13%. Hence, the average break even cost for obtaining the vaccine and administering it to adults was $43.07 for each vaccinated individual (Nichol et al., 2003). Key drivers of cost were; vaccine effectiveness and hourly wage in lowering the use of health care and productivity losses. In conclusion Nichol, Mallon, and Mendelman (2003) asserted that the cost-benefit analysis on the basis of the outcome of the live attenuated, intranasal, trivalent influenza virus vaccine trial provides extra evidence that vaccination against influenza can produce both economic and health benefits for working adults that are physically fit and healthy.

Evaluating the Cost effectiveness of vaccination in a work place, Postma et al., (2002) stated that, various researches on the benefits and cost of carrying out influenza vaccination on a year to year basis have been carried out in so many countries with most of the results showing that these programs are having monetary benefits to the employer. Also, re-evaluating the 11 health, economic studies that were conducted between the year 1979 and 2000 (a twenty-one-year review), findings shows that, a total number of eight researches indicated that influenza vaccination was beneficial to the employee (Postma et al. 2002).

Aballea et al. (2007) however, cited the work of Bridges et al. (2000) who in their study suggests that; influenza vaccination has a tendency to be cost effective when tackled for the viewpoint of third-party payers and the "case for the proposed policy is strengthened when a more comprehensive societal viewpoint is taken" (Aballea et al., 2007). The opportunity cost of lost productivity resulting from Influenza-Like Illnesses (ILI) is significant (Bridges et al., 2000). Aballea et al. (2007) had put this into consideration together with the 2001 Cochrane review while carrying out their research. They stated further that, productivity effects do not come to play only when considering saving time is as a result of averted illness, but also to the time required for the influenza vaccination itself. Also, the vaccination administered in place of work can help reduce the time lost as a result of interruptions to normal working patterns and time lost in travelling to places of vaccination. Consequently, "delegating vaccine administration to staff whose time carries a lower opportunity cost can allow coverage to be expanded more effectively" and this process is likely to be practically required (Aballea et al., 2007).

8. Other Studies Reviewed

Scuffham and West (2002) asserted that opportunistic vaccination is more effective compared to comprehensive vaccination of all the elderly. However, the study failed to provide details on the marginal cost-effectiveness between a comprehensive and opportunistic strategy, which is likely to be the most important question for the decision making process (Scuffham & West, 2002). While this study recommends that influenza vaccination is most probably cost-effective when viewed from the restricted point of view of third-party, the case for seasonal vaccination policy for the elderly is strengthened when it is viewed from a more comprehensive communal perspective (Scuffham & West, 2002). According to authors, it is cost effective in carrying out a comprehensive influenza vaccination of adults, specifically that elder ones. However, their research failed to account for the marginal cost effectiveness between the comprehensive and opportunistic strategy of influenza vaccination and this is one very key factor which should be taken into consideration before deciding on what strategy to apply.

"The opportunity cost of lost productivity" as a result of ILI (Influenza-Like Illness) is extensive (Bridges et al., 2000; Demicheli et al., 2004). However, the productivity effect did not only apply to the amount of time saved due to prevent illness, but it also applied to the amount of time required for carrying out the vaccination. Many countries now employ the use of economic evaluation, cost-effectiveness, and cost benefit analysis to make decisions as to vaccination policy, such as countries in Europe, Australia, and North America. Iglesias, Drummond, & Rovira (2005) carried out such study in Latin America to find out if it is beneficial to administer comprehensive influenza vaccine in the elderly. The study revealed that vaccination of the elderly from the societal point of view is considered to be cost-effective and beneficial. This study was aimed at providing decision makers with certain considerations for possibly expanding the vaccination policy, which will help in improving and controlling the yearly influenza epidemics and in preparation for a disease outbreak (Monto, 2005; Stohr & Esveld, 2004).

9. Conclusion

Subsequent to a careful review of available literature relevant to influenza vaccination in people between the ages of 18 and 65 years, and older, several conclusions can be drawn. Firstly, mortality and morbidity in people 65 years and above with chronic diseases is reduced by influenza vaccination. It has also been established that influenza vaccination is very effective in the reduction of mortality and morbidity in older people in a medical setting. When pneumococcal vaccination is administered alongside influenza vaccination, the cost effectiveness and cost-benefit is optimum. Since it was discovered that it is important to vaccinate pregnant women at any stage of the pregnancy because of the high risk of chronic diseases, they should be the major priority for influenza vaccination programs.

Healthcare workers are also very likely to be affected with influenza, and since most studies in the review of literature ascertained that it is cost effective and the benefits derived from vaccinating this target population is high, it is essential to also put them in this group high up the priority group for vaccination. When healthcare workers are vaccinated, it does not only protect the worker, but also ensures that health care services are maintained during influenza pandemics, and hence protects vulnerable people from catching the disease. Also, elderly people are known to be at high risk of mortality, and over the years, this group has been the major focus of influenza vaccination programs. Vaccinating this group has been discovered in the review of literature to be cost-beneficial, and hence it is important that this target group be emphasized on for the purpose of influenza vaccination. Also important to mention are those with particular chronic illness. This group is also at a very high risk for severe influenza-related illness. The influenza vaccination program has targeted this group in the past, and it still continues to be high on the priority list for influenza vaccination. However, one challenge identified for this target group is identifying these individuals and bringing them to take the vaccine. In conclusion, this review of literature has shown that there are countless number of studies that have proven that it is cost effective and cost-beneficial to vaccinate adults between the ages of 18 and 60 against influenza.

B. HOW FLU VACCINATION AFFECTS MILITARY PERSONNEL READINESS

According to D'Amelio, Biselli, Calì, and Peragallo (2002), despite the benevolent clinical course of influenza, it can lead to mortality, acute suffering, and absenteeism from work, especially in the elderly and those who are medically at high-risk. The prevention of influenza comprises of strain specific vaccination that is expected to be recurrent every year as a result of influenza's high antigenic variability (D'Amelio et al., 2002). It is possible that influenza can represent a significant barrier to military readiness, especially when putting into consideration the infectivity of influenza within closed communities. Regardless of these epidemiological circumstances, vaccination for influenza is rarely incorporated into the mandatory military vaccination program globally.

In line with this, D’Amelio et al. (2002) suggested that this can be as a result of various circumstances such as the need for yearly administration (with development of organization and economic efforts), an absence of assurance in the effectiveness of the vaccine, incorrect postulation that influenza is not a disease with severe impacts, inconsistent outcomes of cost-effectiveness analyses (cases of which are not yet made particularly for the military environment) (D’Amelio et al., 2002). According to authors, the availability of very efficient, economic vaccines that are easily administered, together with tailored and thorough cost effectiveness analyses, will most probably have impact on the role that the military plays in the mission of combating influenza globally.

The Centers for Disease Control and Prevention (2014) further identified influenza to be a viral condition that most generally affects the respiratory tract. In a report by the Centers for Disease Control and Prevention (2014), about 5% to 20% of the population of the United States is affected by the flu on a yearly basis, in which not less than 200,000 individuals are hospitalized. Influenza rates across the military differs every year, with a study by Russell et al. (2005) reporting that 10.6% of trainees in the military was affected by influenza, not excluding five people who had already taken immunization against the disease (Russell, et al., 2005), while a study by Wang, Tobler, Roayaei, and Eick (2009) reported that about 7.8% to 19.4% of armed forces contracted the flu, depending on the status of immunization (Wang et al., 2009). Hence the authors concluded by stating that influenza has an immediate negative effect to a military readiness, and hence influenza vaccination in the military should be of great importance (Wang et al, 2009).

In a study by Johns et al. (2010) aimed at exploring the effects of influenza vaccination in the military asserted that those military personnel younger than 25 years had 50% effectiveness. Shockingly, the effectiveness of members in the military between the ages of 25–29 years was -6%, contrasted with the age group 30–39 years with just 9% effectiveness (Johns et al., 2010). This study reported no significant effect on the influenza vaccination on readiness. However, Wang et al. (2009) reported a predominant effectiveness among service members upon usage of the inactivated virus method for vaccination; which was an astounding result, as service members are consistently urged to get the live virus. According to the authors, it is expected that the armed forces defending a nation should be prepared at all times, and hence influenza vaccination plays a vital role in keeping them prepared (Wang et al., 2009).

Several researchers have exhibited an extensive range of conclusions with respect to the effectiveness and efficacy of influenza vaccinations and their capacity to keep up a fit and prepared battling force. The procedure of administration of a vaccine, the infection strand sort, and the patient's age has exhibited diverse effectiveness and efficacies. Despite the fact that studies have indicated noteworthy effect to more youthful military individuals, the general impact on work non-appearance is a simple 0.04 working days by and large (Demicheli, et al., 2014). Thusly, it becomes imperative to ask the question: can there be any improvement in the process so as to keep military personnel always prepared? With the effectiveness of vaccination ranging from 50% to -6% in view of age, it is clear that particular demographics can possibly modify the general effectiveness of influenza vaccinations (Johns et al., 2010).

Be that as it may, further research is important to outline the compelling age ranges for vaccination and also the effect of inactivated and live viruses on those predefined age ranges, the study by John et al. (2010) suggests. Hence, changing vaccination techniques to match particular age ranges creates a potential to quickly reduce the general occurrence rates of influenza among military members and diminish the expense for pointless vaccinations. According to John et al. (2010), such expenses presently resemble cost shirking by the DOD, particularly since military individuals do not pay a co-pay, in any case this can however be lessened by upwards of $0.70/person in direct expenses basically by reducing vaccinations for age ranges which normally are less probable to influenza. In conclusion, John et al. (2010) suggested that significant evidence infers vaccination for military personnel under 25 years would be cost-effective and give the best advantage per vaccination, while still keeping the young minds prepared at all times.

There is limited current research on the effectiveness of influenza vaccination on military readiness and influenza incidence. However, despite the fact that Warburton, Jacobs, Langsford, and White (1972) reported an effectiveness of 78%, while Cohen, Brezis, Block, Diederich, and Chinitz (2013) reported an effectiveness of 84%, having more exact percentage range that can be adjusted to the distinctive requirements of a community is capable of giving military healthcare personnel an objective for increasing the likelihood of preparedness against disease in times when they are called to duty. The author further suggested a connection between the idea of resistance to influenza among a confined military populace and lower incidence rate of influenza (Cohen et al., 2013). However, Cohen et al. (2013) stated that in spite of the fact that causation cannot be determined from this information set and more research ought to be carried out, the thrilling dissimilarity of incident rates among generally homogeneous populaces must be recognized. Immunity against influenza for all military personnel can, at least, enhance the possibility for vaccination success in line with military preparedness.

The Department of Defense when reacting to influenza pandemic ensures that its employees are not affected and this includes all military personnel, all regular citizens working under the Department of Defense, and all non-permanent staff carrying out their basic duties (Kapp & Jansen, 2009). The reason that the Department of Defense acts in such manner is because the disease is capable of impairing a great number of their workforce and hence impacts national security negatively. For example, it is possible for an influenza outburst to render maritime boats inactive in mission accomplishment, shut down a reasonable number of support and training exercises, cause disorderliness in the supply chain that is responsible for deploying attacking forces, and extremely damage security at critical sites (Kapp & Jansen, 2009). From the above, it can be clearly seen that influenza vaccination of the military is capable of increasing their preparedness. In other words; influenza vaccination of the military can increase their preparedness in all effects. The Department of Defense has a laid down strategy of following all vaccination recommendations as provided by the Centers for Disease Control and Prevention and its Advisory Committee for Immunization Practices. This usually follows all requirements of the Food and Drug Administration, which acts as a guide (Kapp & Jansen, 2009).

As indicated by Thomas, Jefferson, and Lasserson (2010), in their study carried out in France to check for the effectiveness of influenza vaccination on military preparedness in a set of military personnel in 40 offices. The results of this study showed that effectiveness level for military personnel between the ages of 25 to 40 years was higher than military personnel above this age gap. The authors of this study concluded that it is of utmost importance for military personnel to be vaccinated against influenza on a yearly basis to always keep them prepared all through the year in case of combat and other administration activities (Thomas, Jefferson, & Lasserson, 2010).

According to Lynch (2009), since the production of influenza vaccine has significantly increased, the problem resulting from shortages of vaccines has to a large extent been tackled as there is more vaccine in the market. If however, a problem resulting from shortage of vaccine occur, it might be required that the influenza vaccination be administered to patients with the highest exposure (Lynch, 2009). In other words, vaccination should start with those patients who have high degree of contact with the influenza before those with lesser exposure (e.g., delayed length and recurrence of contact) (Lynch, 2009).

Mayet et al. (2010) asserted that throughout history, it can be figured out that the military has always been plagued by the problem of dealing with infectious disease. Nowadays, infectious diseases keep on posing a significant danger to the operational limit of military strengths and constitute one of the biggest segments of the dreariness classification known as ailment and non-fight injury. The military troop of France and Luxembourg were reported with several incidences of mumps (Mossong et al., 2008) and pertussis (Mayet et al., 2010). There are so many underlying reasons that have resulted to the higher incidence rate of diseases among the military. One of the identified reasons is congestions, due to the fact that most of them are required to perform all training and even live in congested conditions. Another factor is the increase in the use of biological weapons by the military. Also, the fact that military recruits are exposed to various influenza pathogens during missions like that of combatant or peacekeeping is another factor that contributes to the rapid growth of these diseases (Mossong et al., 2008; Mayet et al., 2010).

According to del Corro, Vargas-Roman, Garcia, Prieto, and de Miguel (2009), the first thing to do in defense of an infectious disease is vaccination. Much information based on evidences has been reported that shows the importance and cost-effectiveness of many available vaccination programs. However, despite the success and high coverage rate of basic vaccination programs in many nations, the circumstance is diverse for grown-up or adult vaccination, where the coverage rates are from the range of 26–65 percent and this is contingent upon the target population and the vaccine and were frequently judged to be inadequate (del Corro et al., 2009). As essentials for government decision making, many components have been proposed to underlie the low rates of adult vaccination coverage: cost-effectiveness analysis, creation and dissemination of disease burden, confirmation of satisfactory vaccine supplies, public opinion, as well as the perception of the medical community (Mahoney & Maynard, 1999; Wenger, 2001).

Furthermore, panic from the reactions of vaccines, as well as the witnessed reduction in infection incidences such as influenza that are preventable by vaccine could also add to the hesitance to be vaccinated. Porter et al. (2009) also discovered that the main variable that determined refusal or acceptance of vaccination was the impression of the safeness of the vaccine. In this regard, the authors concluded that improving the vaccination of the military can go a long way to actually keep them agile and ready to handled situations that may arise.

According to Lemon, Thaul, Fisseha & O'Maonaigh (2002), vaccines have played a vital role in the prevention of infectious disease among the armed forces. The vaccination of the military began when General George Washington made it compulsory for the military to be vaccinated against small pox (Lemon et al., 2002). According to the Artenstein (2009), as a result of the higher risk, it is highly important for military personnel to receive influenza vaccination alongside other vaccinations to receive vaccinations above what the normal man, woman, and kid receive. This study showed that vaccination for military personnel is very important as it can keep them abreast of situations, while also keeping them of several diseases that could destabilize the balance of a nation (Artenstein, 2009).

In conclusion of this part of literature review, it can be said that all the authors who have ventured into studying the cost-effectiveness and impact of influenza vaccination on the military has had positive impacts. Hence, the influenza vaccination is very necessary for the military personnel as it is both cost-effective and also impacts them positively in so many ways such as increasing their preparedness to defend their country and also stay sound to perform administrative duties.

IV. CBA ANALYSIS

A. INTRODUCTION

An old English adage posits that prevention is better than cure. According to Boardman, Wiemer, Vining, and Greenberg (2006) the cost benefit analysis that is under consideration but has not begun, or so cold ex ante analysis, is known as the “most useful” tool for deciding whether resources should be allocated to a particular project or program or not. This cost benefit analysis seeks to determine whether the prevailing cost of treating the influenza conditions was higher or lower than the cost of an active serviceman. Essentially, the cost benefit analysis seeks to establish the positive and negative implications of vaccination (Boardman et al., 2006; Office of the Deputy Assistant Secretary of the Army, 2013). To understand the positive and negative implications, one has to first understand the magnitude of absenteeism by summing all the number of days all servicemen was absent and then calculating the economic implications for active and out of duty costs. A similar approach is used to determine the level of economic impact for other groups.

1. Problem Definition and Opportunity

The military personnel are specifically designed to remain ready for action whenever called upon. The country’s defense is heavily reliant on the readiness and availability of the military personnel within the shortest time. However, military personnel who fall ill tend to create a dent in the defense system since they may be unavailable for service when called upon. The cost of being out of service due to a preventable ailment is significant and should not be tolerated. To be able to understand to immense cost that the government incurs through the treatment of influenza, one only needs to look at the total cost of the treatment against the total cost of a preventive injection. The proposed option is for the government to adopt a preventive approach rather than a curative approach. The evidence that will be presented is aimed at showing succinctly the financial and servicemen benefits that the government stands to share.

2. Definition of Scope, Facts, and Assumptions

Scope of the project includes only citizens of the Republic of Armenia. Project counts the only costs and benefits that relates to citizens of Armenia. Military Medical Department of the Armed Forces of Armenia provided relevant facts such as nine years morbidity data and respective costs that have a direct bearing to the cost benefit analysis. This investigation explores the cost benefit analysis of three fundamental influenza ailments. The first ailment is the general complication that is attributed to influenza infection. Given the geographic location of the country, the likelihood of influenza complication is high as will be seen in the analysis section. The second ailment to be considered in this analysis will be bronchitis. Bronchitis is heavily associated with cold and dust, which leads to chest congestion. Such congestion blocks a person from participating in activities that require heavy breathing. Indeed, the army is required to undertake daily exercises to ensure that they remain fit for duty. Consequently, a bronchitis soldier is useless in active service as long as s/ he has the ailment. The third ailment under consideration in this analysis is pneumonia. Pneumonia, which is caused by pneumococcus leads to the chest filling up with fluid, which makes it hard for the patient to breath effectively. In a mission that requires operating under silence, such a soldier may find it hard to function because s/ he has to breath heavily in order to pull in enough air into the lungs.

It is generally assumed that during daily trainings, military personnel are engaged in various forms of exercises that range from active combat to mountaineering to stealth attacks. Each of these exercises is aimed at preparing a soldier to function under different terrain with relative ease. However, army personnel who have an influenza infection may find it significantly hard to perform these exercises because of the infection. Besides, an influenza infection may also be accompanied by coughing that is irritating and distracting to other personnel within a given field. Moreover, influenza infection is an air-borne disease, which means that it can be transmitted to other army personnel with relative ease. A fast spreading influenza strain may cause a huge population of the army personnel within an army barrack to fall ill, thereby rendering the barrack and the country at risk in the event of an invasion.

Furthermore, these army personnel continue to receive full payment even when they are out of service due to an influenza infection. The government is expected to settle the medical bills of these ill army personnel while also paying them for service they did not deliver. Consequently, the government incurs huge financial burdens to protect the army.

3. Definition of Alternative Documents

The alternative option in this case is to vaccinate the entire army personnel. The cost of vaccination is moderately lower than the cost of treating these personnel. Vaccination provides immunity to the body, which reduces the chances of a severe infection next to none. The effectiveness of vaccines makes it possible for the body to counteract the destructive nature of an infection by producing antibodies, which fight an infection. For instance, a pneumonia vaccination will help the military to reduce the huge number of cases of pneumonia infection. Each year thousands of army personnel are forced to seek medical leave due to an avoidable infection. The same case goes to bronchitis and other influenza complications. Vaccination will equip the army to function even when there is an influenza circulating. To understand the benefits of an influenza vaccination, one has to consider the cost and benefits of the vaccine.

B. COST ESTIMATE FOR EACH ALTERNATIVE; FLU MORBIDITY LEVEL FOR SERVICEMEN

1. Days Lost through Influenza Infection

To understand the impact of influenza on the performance of servicemen and other affiliates, one needs to explore the amount of time spent out of duty (see Figure 1, Figure 2, and Table 2 in the Appendix). The number of servicemen that fell sick between the year 2006 and 2014 is moderately high (Military Medical Department, 2014). The number of servicemen that had influenza infection in the year 2006 was 27,890, which included 22,986 that were outpatient while the rest were inpatient. The resultant effect of this infection was a total of 71,256 days lost through absenteeism. Likewise, the number of servicemen that fell ill in the year 2007 was 23,468, which included 20,896 outpatients while inpatient cases amounted to 2,572. The resultant effect of these numbers of infections was a total of 76,404 days of absenteeism. Apparently, this number of absenteeism was higher than the previous year, despite the number of cases being lower in total.

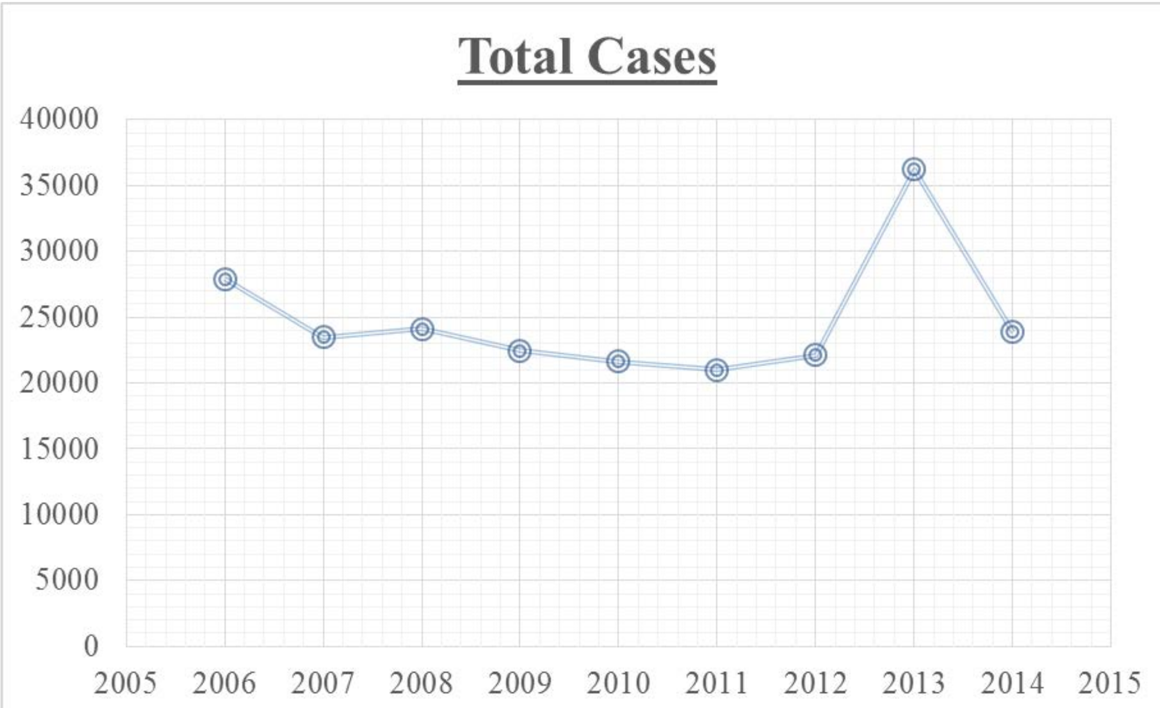

Figure 1. Total Cases over the Years. Adapted from Military Medical Department (2014).

The total number of servicemen that came down with flu in the year 2008 was 24,096 with 22,384 being outpatient and the rest inpatient patients. The resultant impact in terms of service days lost is high. In the year 2009, there were 22,474 cases of flu infection, which resulted in high number of outpatient cases. Subsequently, a total of 60,121 days of absenteeism from all these cases were accrued. Similarly, the number of influenza infection among servicemen in the year 2010 was 21,629, which represented a large number of absentees and days lost in the process. Moreover, the year 2011 saw a total of 21,024 influenza infection among servicemen out of which 19,986 were outpatient cases while the rest were inpatient cases. In 2012, there were 22,119 cases of flu infection among servicemen, which accounted for a significant number of outpatients, inpatient, and absenteeism cases. Still, the year 2013 and 2014 also have a moderately high number of absentees, outpatient, and inpatient cases.

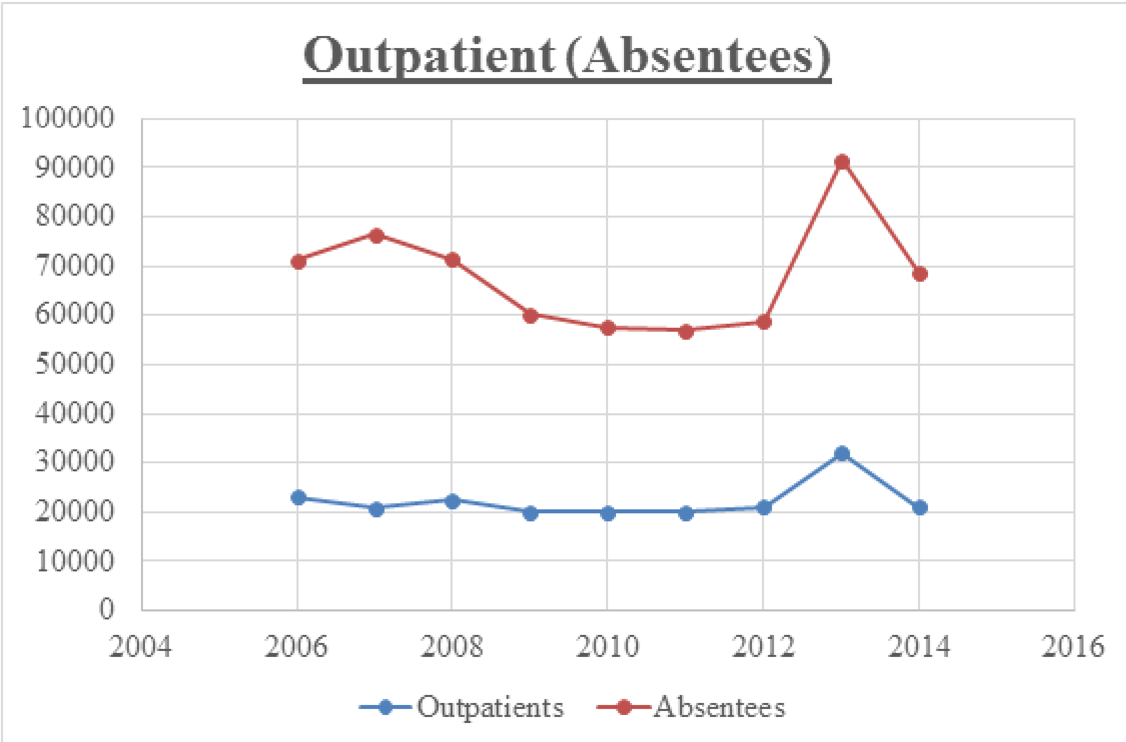

Figure 2. Outpatients and Absenteeism. Adapted from Military Medical Department (2014).

It is apparent from this investigation that Armenia loses out on the service of many of its men due to an illness that can be contained through immunization. Lack of immunization costs the Armenian military a huge number servicemen hours a year. Each service day that is lost by servicemen falling sick under influenza compromises the integrity of the country's intelligence and security framework. Moreover, these infections were taking a huge toll on the economy of the country.

2. Cost of Absenteeism

To better understand the economic impacts of these infections, one needs to determine the cost of absenteeism from work their regular jobs. The average cost of absenteeism per serviceman day was $7 (Military Medical Department, 2014). From

Figure 3 and Table 2 in the Appendix, it is apparent that in the year 2006, the total cost of absenteeism was $ 498,792 while the cost of absenteeism in the succeeding year was $ 534,828. Still, the cost of absenteeism in the year 2008 was $ 500,206 while the figures for the years 2009 through 2012 were $ 420,847, $ 402,794, $ 398,055, and $ 411,922, respectively. Also, the cost of absenteeism for the years 2013 and 2014 were highest $ 639,933 and $ 480,564, respectively.

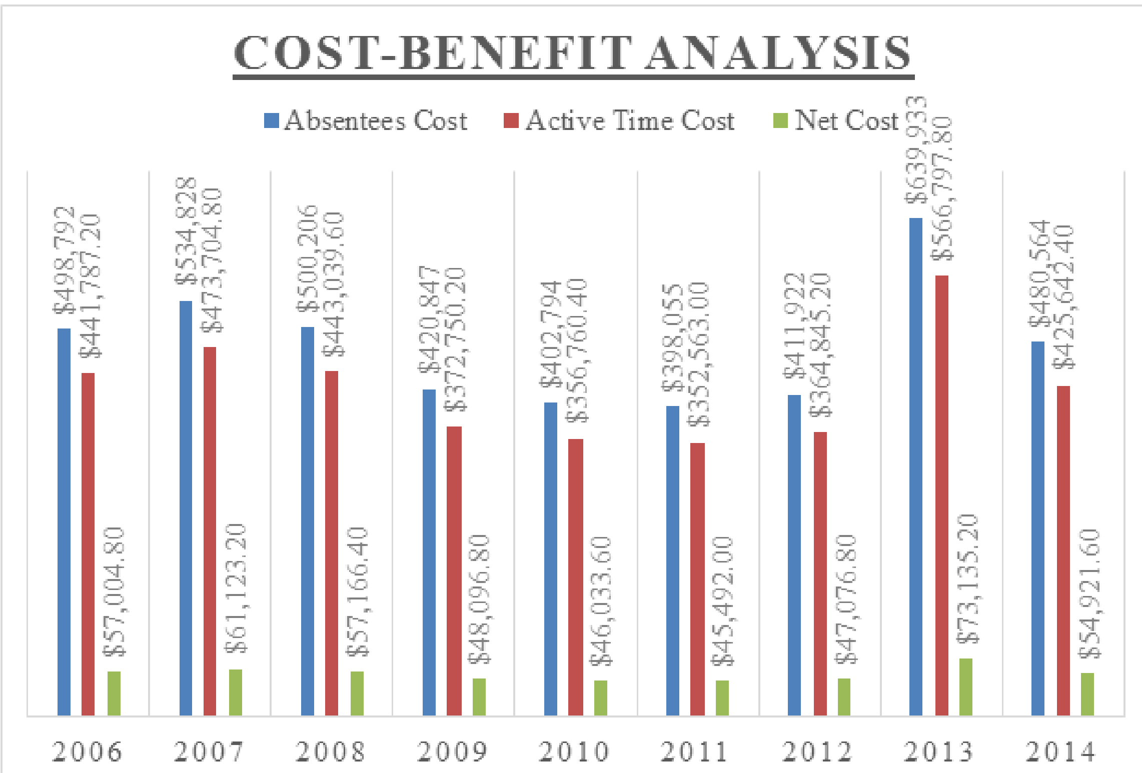

Figure 3. Cost of Absenteeism. Adapted from Military Medical Department (2014).

3. Cost of Active Soldier Service

If these soldiers were healthy and in active duty, then the cost of their active service would be calculated at a cost of $ 6.2 per day (Military Medical Department, 2014), as shown in Table 2 in the Appendix. Consequently, their respective costs would have been lower than the ones incurred during their medical off days. The cost of active service time for the lost number of days in the year 2006 would have been $ 441,787.20 while the succeeding year's cost would have been $ 473,704.80. The cost of active time for the lost days in the year 2008 through 2012 would have been $ 443,039.60, $ 372,750.20, $ 356,760.40, $ 352,563.00, and $ 364,845.20 respectively. Moreover, the cost of active time for the lost days in 2013 and 2014 would be $ 566,797.80 and $ 425,642.40, respectively.

4. Potential Net Savings

If the soldiers were on active duty, they would have been able to save the government a substantial amount of money. The difference between the cost of absenteeism and active duty per day is $ 0.8, which represents the number of savings per day. The net savings for the years 2006 through 2010 would have been $ 57,004.80, $ 61.123.20, $ 57,166.40, 48,096.80, and 46,033.60 respectively. The net savings from the years 2011 to 2014 would have also been $ 45,492.00, $ 47,076.80, $ 73,135.20, and $ 54,921.60, respectively (see Table 2 in the Appendix). The resultant effect of lack of immunization of service men is uneconomical for the country based on the prevailing nine years' data. In all cases, the country would have benefited greatly through huge financial savings.

Table 3 in the Appendix and Figure 4 show the number of cases of inpatient servicemen that were hospitalized due to influenza. The number of patients then classified based on individual medical condition that include influenza complications, bronchitis, and pneumonia cases. From all individual medical inpatient cases considered, influenza complications were the highest of the three categories considered from the year 2006 to 2014. The year with the lowest number of influenza complications was 2011 with only 211 cases while the year 2013 had the highest number of cases at 1,348 cases. The second highest medical condition in general is bronchitis while Pneumonia cases were the least number of cases. The lowest number of bronchitis cases was in the year 2011 at 118 cases while the highest value was in the year 2013 at 861 cases. Likewise, the year with the lowest pneumonia cases was still 2011 while the one with the highest cases was 2013 at 487 cases.

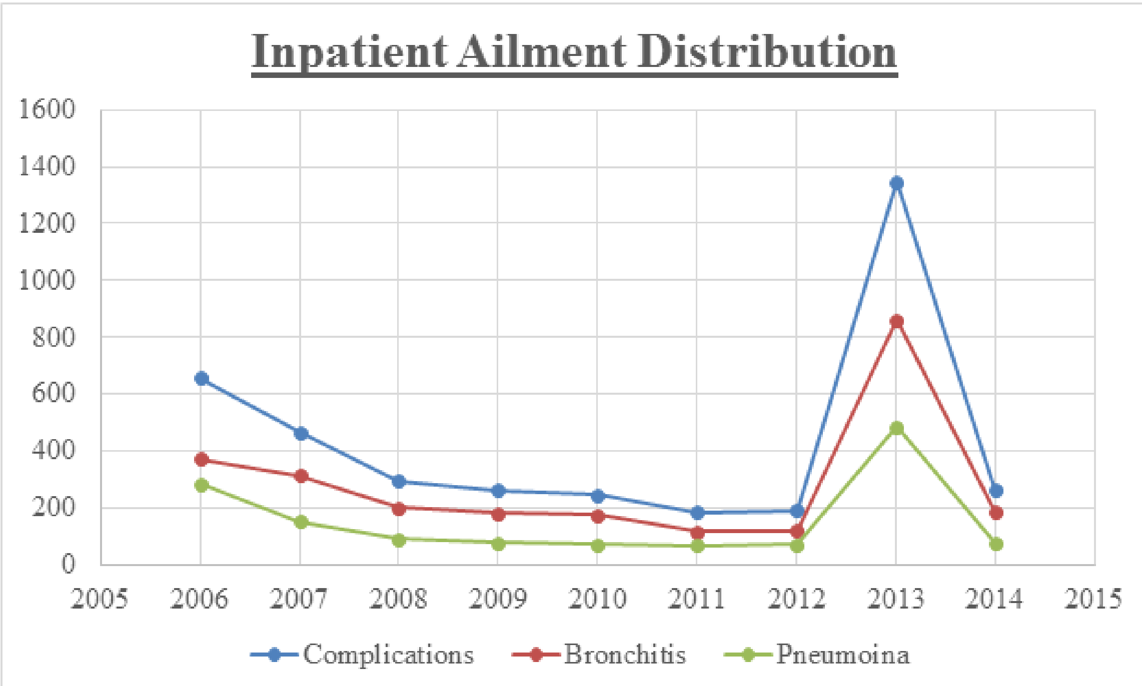

Figure 4. Distribution of Inpatient Ailments. Adapted from Military Medical Department (2014).

Figure 5 and Table 4 in the Appendix show the financial implications of treating each of the inpatient cases. Apparently, the year 2011 had the lowest amount of finances going to the treatment of inpatient cases. As seen in Table 4, the year 2011 recorded the lowest inpatient cases in all categories. Subsequently, the cost of treating influenza complications, bronchitis, and pneumonia for the year 2011 was $ 81,840, $ 51,920, and $ 42,160 respectively. In contrast, the year with the highest number of cases was in 2013 with the resultant cost for influenza complications, bronchitis, and pneumonia for the year being $ 593,120, $ 378,840, and 301,940 respectively. All other cases had moderate figures. The computation of the cost per day was based on $ 440 for influenza complications and bronchitis, $ 620 for pneumonia in all years (Military Medical Department, 2014).

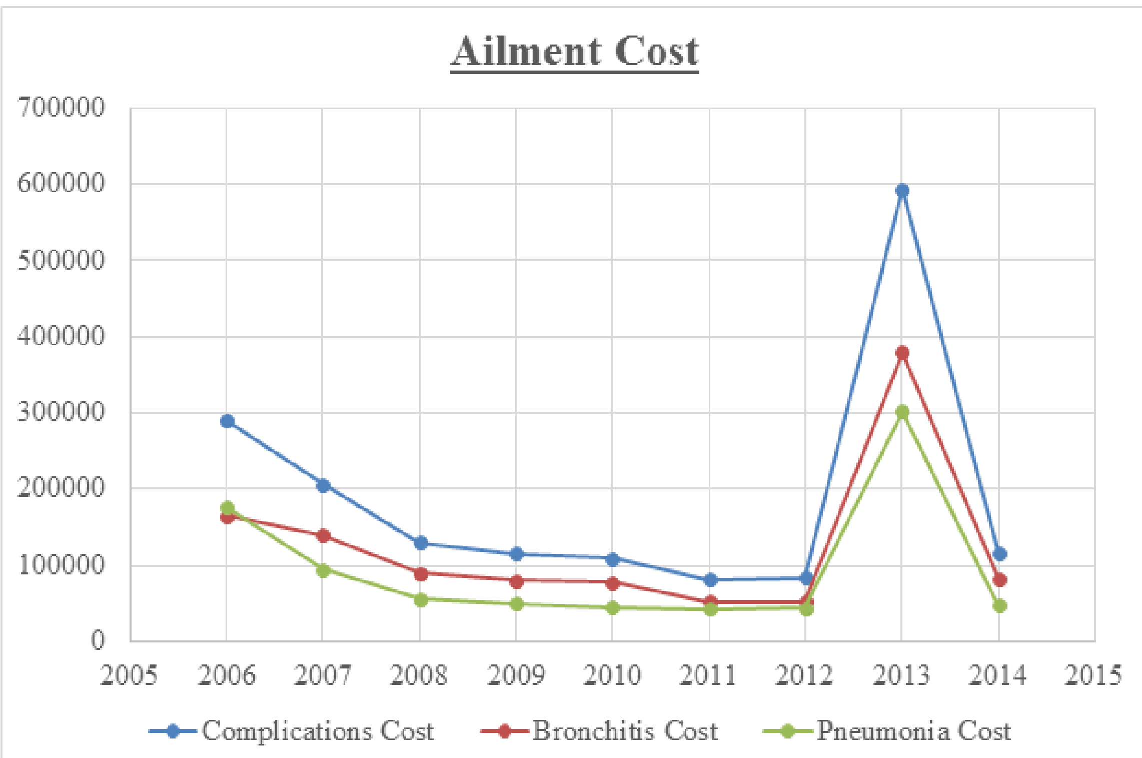

Figure 5. Cost of Ailments. Adapted from Military Medical Department (2014).

C. FLU MORBIDITY LEVEL FOR OFFICERS, CONTRACTORS, AND CIVILIANS

1. Days Lost through Influenza Infection

The number of influenza infections for officers, contractors, and civilians is moderately lower than their active duty counterparts. The highest recorded number of infection for this category is 1,842 that were in 2013 (see Figure 6 and Table 5 in the Appendix).

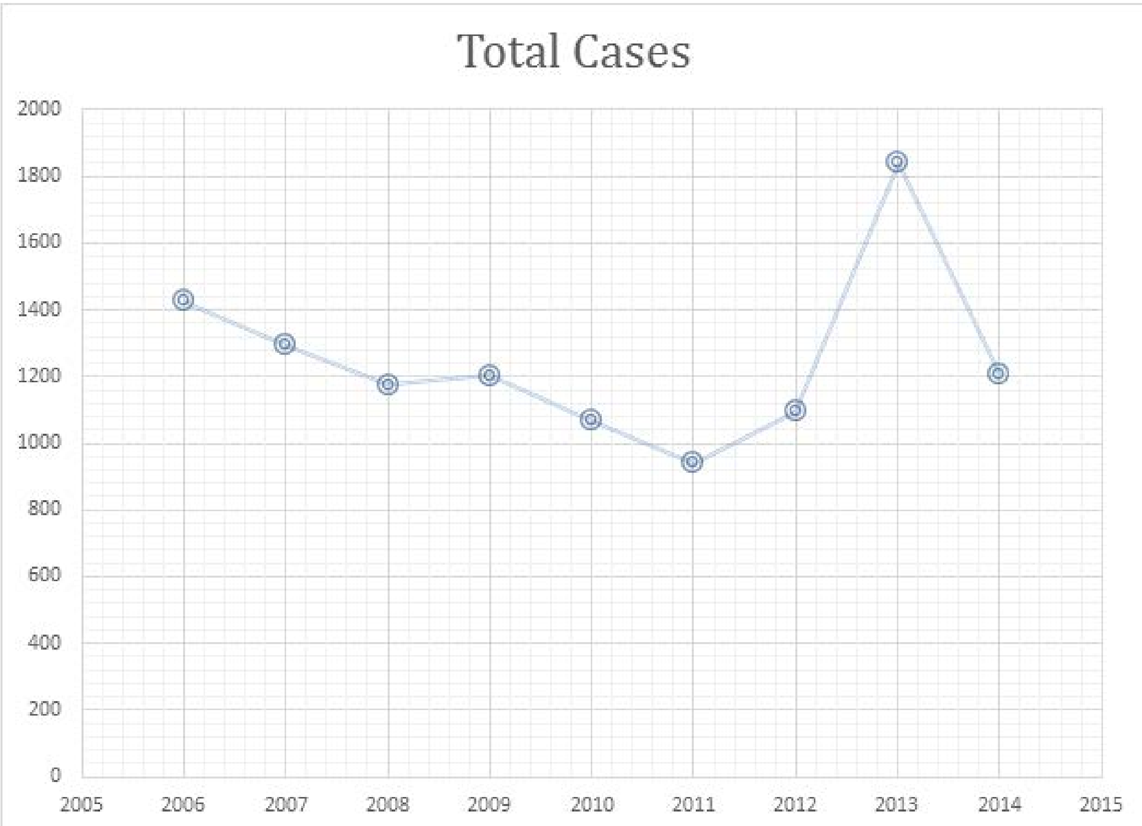

Figure 6. Total Number of Cases for Officers, Contractors, and Civilians. Adapted from Military Medical Department (2014).

Similarly, the number of outpatient and absentees for the other officers, contractors, and civilians is significantly lower and so are the associated costs, as shown in the Figure 7.

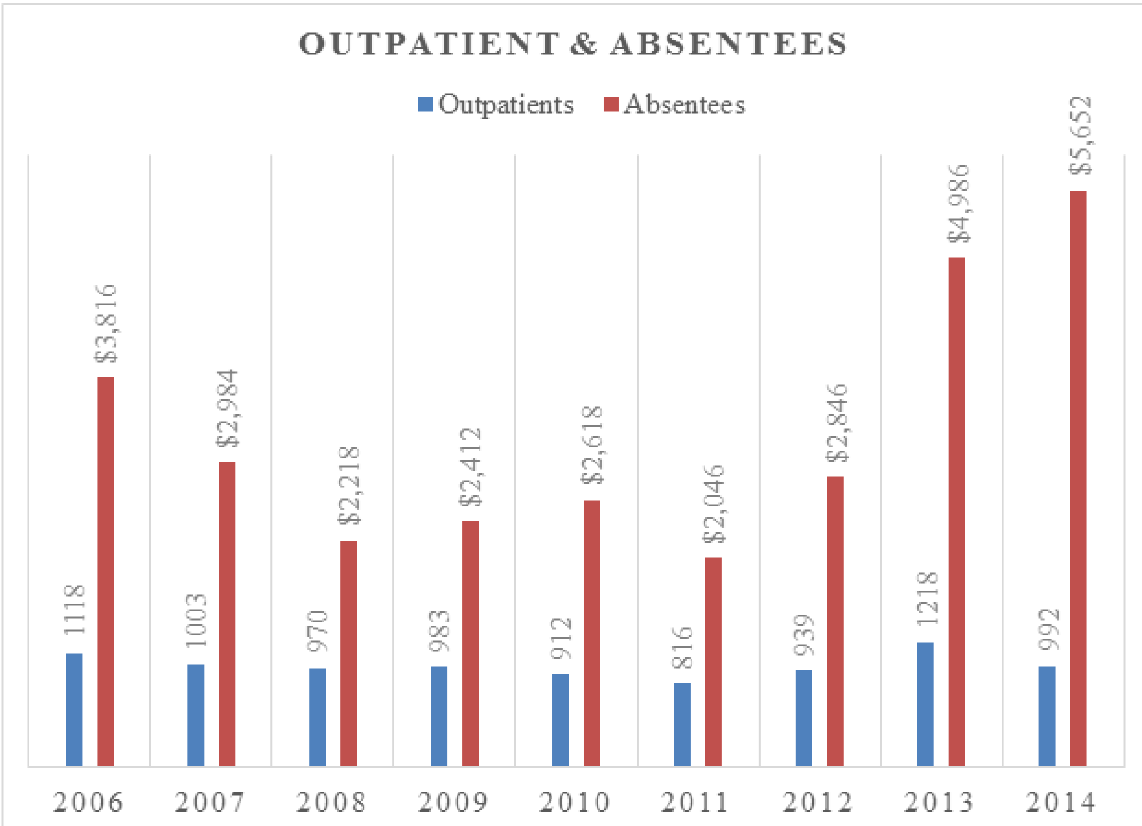

Figure 7. Outpatients and Absenteeism among Officers, Contractors, and Civilians. Adapted from Military Medical Department (2014).

The cost of treating these ailments for the other officers, contractors, and civilians is far lower (refer to Figure 7) than for treating the conscripted personnel. It would appear that the training environments for the military officers expose them to infections as opposed to their spouses and other dependents. However, evidence suggests that the year 2013 had the highest number of infections in all cases.

2. Ailments Cost

When compared with the active military personnel, the cost of ailments for these dependents is much lower. Figure 8 shows that the highest cost for complications for this group was in 2013 at $130,240 while bronchitis and pneumonia cost was $ 78,320, and $ 73,160, respectively.

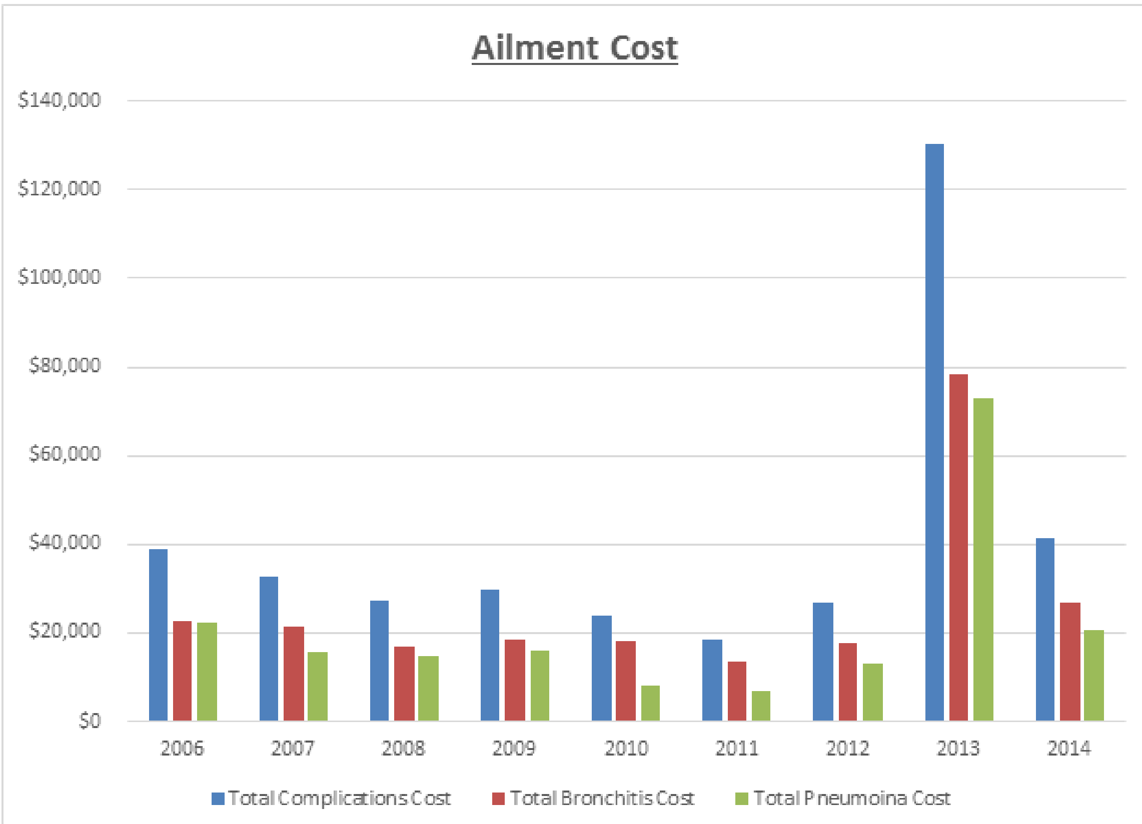

Figure 8. Cost of Ailments among Officers, Contractors, and Civilians. Adapted from Military Medical Department (2014).

3. Quantifiable and Non-quantifiable Benefits

The average accrued cost of outpatient and inpatient cases for the nine years under consideration is respectively $ 98,894.49 and $ 411,026.67. The cost of vaccinating these servicemen would be $ 458,660, which is the product of the cost of a 10 dose-vaccination pack costing $95 (A. Grigoryan, personal communication, July 8, 2016) and the number of packets required that is 4,828, because single dose vaccination is recommended (“Single-dose,” n.d.).

Cost of vaccine

= Number of packets required X cost of a 10 – dose vaccination packet

= $ 95 X 4828 = $ 458,660

An average cost-benefit analysis would indicate that there would be an average savings of $ 51,261 (see Figure 9). Even at such a high cost of vaccine, there are still benefits in vaccination. When the cost of vaccination is as high as $ 95, the benefit received is lower on average. Yet, this benefit is a better outcome for the government. The $ 51,261 is a financial gain in terms of service and economics.

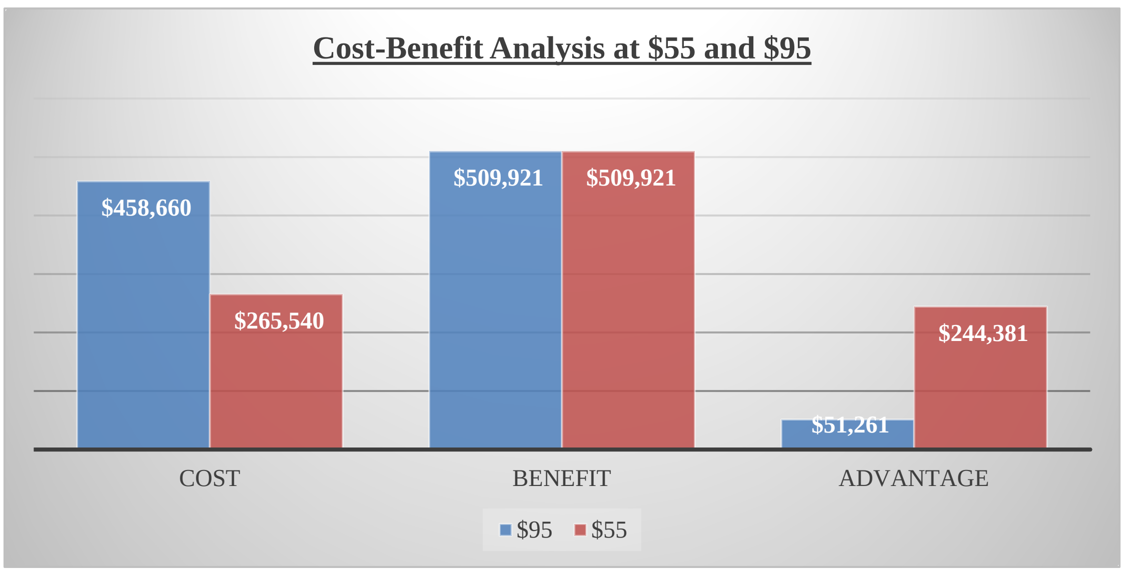

Figure 9. Cost-Benefit Analysis at $55 and $95 Cost of Vaccine

However, the cost of vaccination may also go as low as $ 55 (A. Grigoryan, personal communication, July 8, 2016), which is significantly lower. The lower the treatment cost, the better the country stands to benefit from the financial burden. A quick comparison of the financial benefits of treating the ailment at $ 55 implies that there are enormous annual benefits on average. The cost of vaccination goes as low as $265,540 while the benefits will stand at $ 509,921. The resultant advantage from such a low vaccination cost is a financial saving amounting to $ 244,381 (refer to Figure 9). Nevertheless, the savings indicated are at 100 percent. Realistically, the level of efficiency for the vaccine will be between 65% and 70% (Breteler et al., 2013; Nichol et al. 2003; Demicheli, et al., 2014). At 65 percent, the country would save between $ 33,320 (65% of 51,261) and $ 158,848 (65% of 244,381). Likewise, an efficiency level of 70 percent would lead to a financial savings of between $ 35,883 and $ 171,067. Assuming that the number of military personnel remains the same, the resultant cost of influenza treatment would total $ 802,655 over the next five years. Moreover, the total savings within the same timeframe while using the vaccination model would amount to between $ 166,600 to $ 794,240 for a 65 % efficiency level and $ 179,415–$ 855,335 for a 70 % efficiency level (see Figure 10).

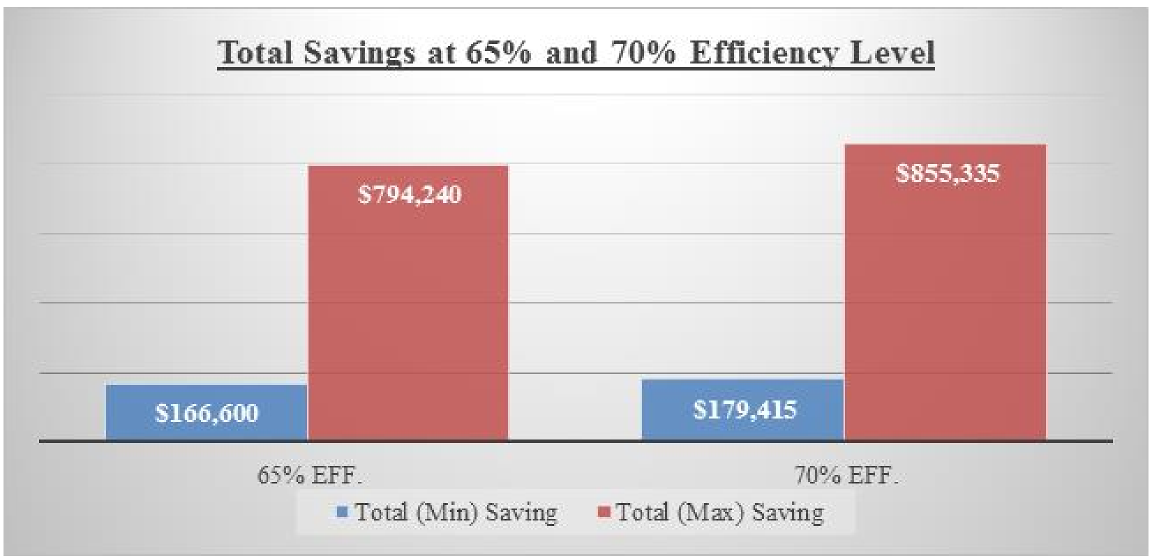

Figure 10. Total Savings at 65% and 70% Efficiency Levels

Moreover, the net present value for the next five years with the 8% discount rent will be $2,289,198 as indicated in Table 6 in the Appendix. The intangible benefit from such investments is that the government will no longer have to invest in medicine. Besides, all army personnel will be in active duty unless they are on scheduled leave days. The country’s military personnel will be ready for action whenever called upon to serve and defend the country. It is apparent that an attack may emerge at any time. Thus, the military will always be ready to repel such infiltrations, thereby protecting the integrity of the country. Other intangible benefits will include a sharp reduction in the number of absenteeism due to influenza infections. Consequently, there will be a sharp improvement on army personnel service time. Also, the medical personnel time will be used for other constructive research and activities to improve the health and welfare of the general military staff. Thus, the qualitative measures such as morale, readiness, and quality of life will be significantly high.

Apart from the financial savings that the country will benefits from, the country stands to benefit from active and dependable service from its military personnel. The option of treating army personnel and their dependents is quite high already. For such a small country, such financial burdens cannot be bore any more when there are alternatives that have better promises. The option of treating the army personnel has been passive and resulted in massive government expenses each year. Such expenses can be shelved or redirected to other constructive activities. The option for vaccination proves to have multiple benefits. On one hand, the military personnel will have immunity to influenza infections. Depending on the dose accorded, these personnel will be able to withstand nasty infections, which will improve their service to the nation. Another benefit is a sharp reduction in the medical financial burden for the military. The cost incurred in treating these personnel will be used for other activities or used to reinforce the country's military capabilities. The third benefit is that these military personnel will serve better when they are healthy.

D. DEFINITION OF ALTERNATIVE SELECTION CRITERIA

An alternative selection criterion may include reducing the risk of exposure to the influenza agent. It is possible for a comprehensive research to be undertaken to determine regions that are prevalent to influenza pathogens and the seasons. During these seasons, the number of army personnel venturing into these areas can be reduced, thereby reducing the risk of exposure. Nevertheless, this defensive approach may not work effectively because influenza is an air-borne disease. Another alternative selection criterion is for the government to liaise with companies like GlaxoSmithKline and Merck among many other companies that produce influenza vaccination. Since the vaccination will be for a large population, the government can then negotiate the price for annual vaccinations to come to as low as $55. Such a low price will lead to massive financial savings for the government. Furthermore, the contracted company will benefit from the sale of its vaccines within a significantly short time. Besides, this company will also benefit from a multi-year vaccination deal that will help in raising its revenue, proper budgeting, and financial projections.

E. COMPARISON OF ALTERNATIVES

Comparison of costs of status quo and proposed status reveals that using a vaccination program may bring to annual financial saving of $392,476.65 (see Table 1). A number of risks are inherent to the vaccination option. First, the computation of benefits and financial savings were done using the number of ailing army personnel. Nevertheless, the cost of vaccination will have to include the entire military, which will be a higher cost and financial risk nonetheless. It is possible to have savings assuming that the entire army is at risk of influenza infection. There is a possibility that this shift in treatment approach will receive political reproach, especially from politicians who feel that spending an exorbitant amount of money on vaccination for the entire army is ill-informed. Given that the army is paid by government, there is the possibility of rejection of the vaccination due to constraints in the country’s capital structure. Besides, excessive spending is impractical for a developing economy.

Table 1. Comparison of Alternatives

Treatment Cost	Current Status	Proposed Status
Absenteeism Cost	**$ 476,438.00**	**$ 166,753.30**
Complication Cost	**$ 191,692.00**	**$ 67,092.20**
Bronchitis Cost	**$ 124,129.00**	**$ 43,445.15**
Pneumonia Cost	**$ 95,204.00**	**$ 33,321.40**
Cost of Active Time Lost	**$ 421,978.00**	**$ 147,692.30**
Immunization Cost		**$ 458,660.00**
Total	**$ 1,309,441.00**	**$ 916,964.35**
Net Immunization benefit		**$ 392,476.65**

Moreover, relying on the current state of treating the ailments may appear as an option given that some may perceive the savings to be miniscule. However, the risk of maintaining the current process is that the army will continue to be unnecessarily exposed to influenza agents without a defensive mechanism. The solution to this risk is to change the approach and adopt the vaccination option. Although the financial savings may appear small, the non-quantifiable benefits far outweigh the miniscule savings. Moreover, it will be possible to achieve an equilibrium between the cost of treatment and the cost of vaccination with the latter providing more economic benefits that will result in better budgetary forecasts. The vaccination option will also shield the government from unnecessary government's debts and expenditures leading to better utilization of the revenue collected. Besides, the negative impacts of rising inflation rates will be curtails through long-term savings margin. Still the option of shielding the army personnel from exposure to pathogen is in itself a high risk because the military personnel may not be deployed in volatile areas during such season. Vaccination will ensure that the army personnel remain productive, leading to proper expenditure of public fund. Furthermore, the general public who are key stakeholders in public funds will be satisfied when the government exhibits substantial financial savings through innovative means of countering negative expenditure. Thus, the tax burden will be lower with the adaptation of vaccination program. The money saved can also be used to reduce unemployment rate in the country or improve the welfare of the servicemen.

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V. CONCLUSION AND RECOMMENDATIONS

In conclusion, the cost of treating each of the ailments is quite high. The cost of treating influenza complications is much higher than that of bronchitis and pneumonia. Nevertheless, the cost of vaccination is significantly lower on average. A cost-benefit analysis has derived benefits and shows that by adopting the vaccination program the Ministry of Defense of the republic of Armenia will have not only financial savings irrespective of the cost of the vaccine, but also non-financial benefits that will improve daily readiness of Armed Forces personnel. The highest cost of the vaccine was $95, which leads to a financial saving of $51,261 annually. The lowest cost of vaccination is $55, which can lead to an annual financial saving amounting to $392,476.381. Such an amount can be used for other developmental purposes that may include improving the country's military capabilities annually or to or improve the welfare of the servicemen. It is thus recommended that the government adopts a vaccination approach. Vaccinating the entire army will provide the country with an opportunity to save immensely through negotiation for the lowest price for the vaccine.

There are some recommendations for Armenian Armed forces professionals and other researchers who have established interest in military. Primarily, there is an absence of vast literature in context of flu vaccination implementation plan studies in Armed Forces. This project is highly beneficial for Armenian Army in a way that the unexplored additional costs of inappropriate flu treatment are examined thoroughly. Moreover, the framework of this project can be used for further exploration of vaccination implementation in Armed Forces in countries with low economic development. The data drawn in this project and analysis performed can be used for further implication in the regard of subject matter. This work will definitely highlight the importance of flu vaccination in Armenian Armed Forces.

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APPENDIX. DATA TABLES

Table 2. Cost of Outpatient Cases. Adapted from Military Medical Department (2014).

		Outpatients (Absentees)		Absentees Cost $ 7 per day		Active time cost per day $ 6.2		Net Cost to Army $ (0.8)	
Years	Cases	Outpatients	Absentees	Cost	Total	Cost	Total	Cost	Total
2006	27890	22986	71256	$7	$498,792	$6.20	$441,787.20	$0.80	$57,004.80
2007	23468	20896	76404	$7	$534,828	$6.20	$473,704.80	$0.80	$61,123.20
2008	24096	22384	71458	$7	$500,206	$6.20	$443,039.60	$0.80	$57,166.40
2009	22474	20048	60121	$7	$420,847	$6.20	$372,750.20	$0.80	$48,096.80
2010	21629	19947	57542	$7	$402,794	$6.20	$356,760.40	$0.80	$46,033.60
2011	21024	19986	56865	$7	$398,055	$6.20	$352,563.00	$0.80	$45,492.00
2012	22119	20984	58846	$7	$411,922	$6.20	$364,845.20	$0.80	$47,076.80
2013	36218	31894	91419	$7	$639,933	$6.20	$566,797.80	$0.80	$73,135.20
2014	23865	21034	68652	$7	$480,564	$6.20	$425,642.40	$0.80	$54,921.60

Table 3. Inpatient Ailments. Adapted from Military Medical Department (2014).

		Inpatient (Complications, Bronchitis, Pneumonia)			
Years	Cases	Inpatients	Complications	Bronchitis	Pneumonia
2006	27890	4904	658	374	284
2007	23468	2572	468	316	152
2008	24096	1712	294	203	91
2009	22474	1618	262	182	80
2010	21629	1682	248	176	72
2011	21024	1038	186	118	68
2012	22119	1124	191	120	71
2013	36218	4324	1348	861	487
2014	23865	2831	266	189	77

Table 4. Costs of Treatments of Inpatient Cases. Adapted from Military Medical Department (2014).

	Complication Costs 400 US Dollar		**Bronchitis Costs 440 US Dollar**		**Pneumonia Costs 620 US Dollar**	
Years	Complications Cost	Total Complications Cost	Bronchitis Cost	Total Bronchitis Cost	Pneumonia Cost	Total Pneumonia Cost
2006	$440	$289,520	$440	$164,560	$620	$176,080
2007	$440	$205,920	$440	$139,040	$620	$94,240
2008	$440	$129,360	$440	$89,320	$620	$56,420
2009	$440	$115,280	$440	$80,080	$620	$49,600
2010	$440	$109,120	$440	$77,440	$620	$44,640
2011	$440	$81,840	$440	$51,920	$620	$42,160
2012	$440	$84,040	$440	$52,800	$620	$44,020
2013	$440	$593,120	$440	$378,840	$620	$301,940
2014	$440	$117,040	$440	$83,160	$620	$47,740

Table 5. Inpatient Cases. Adapted from Military Medical Department (2014).

Inpatient Cases(Others)					
Years	Cases	Inpatients	Complications	Bronchitis	Pneumonia
2006	1,426	308	88	52	36
2007	1,294	291	74	49	25
2008	1,176	206	62	38	24
2009	1,204	221	68	42	26
2010	1,068	156	54	41	13
2011	942	126	42	31	11
2012	1,094	155	61	40	21
2013	1,842	324	296	178	118
2014	1,206	214	94	61	33

Table 6. Cost-Benefit Analysis for Next Five Years

	Average	Y +1	Y +2	Y +3	Y +4	Y +5	
Costs							
Cost absenteeism	$ 476,438.00	$ 476,438.00	$ 476,438.00	$ 476,438.00	$ 476,438.00	$ 476,438.00	
Complication Costs	$ 191,693.00	$ 191,693.00	$ 191,693.00	$ 191,693.00	$ 191,693.00	$ 191,693.00	
Bronchitis Cost	$ 124,129.00	$ 124,129.00	$ 124,129.00	$ 124,129.00	$ 124,129.00	$ 124,129.00	
Pneumonia Cost	$ 95,204.00	$ 95,204.00	$ 95,204.00	$ 95,204.00	$ 95,204.00	$ 95,204.00	
Active Time Lost Cost	$ 421,987.00	$ 421,987.00	$ 421,987.00	$ 421,987.00	$ 421,987.00	$ 421,987.00	
Total Costs (Future Value)	$ 1,309,451.00	$ 1,309,451.00	$ 1,309,451.00	$ 1,309,451.00	$ 1,309,451.00	$ 1,309,451.00	
Total Costs (Present Value)	**$ 1,309,451.00**	**$ 1,212,454.63**	**$ 1,122,643.18**	**$ 1,039,484.42**	**$ 962,485.58**	**$ 891,190.35**	**$ 6,537,709.15**
Benefits							
Cost absenteeism	$ 643,191.30	$ 643,191.30	$ 643,191.30	$ 643,191.30	$ 643,191.30	$ 643,191.30	
Complication Costs	$ 258,785.55	$ 258,785.55	$ 258,785.55	$ 258,785.55	$ 258,785.55	$ 258,785.55	
Bronchitis Cost	$ 167,574.15	$ 167,574.15	$ 167,574.15	$ 167,574.15	$ 167,574.15	$ 167,574.15	
Pneumonia Cost	$ 128,525.40	$ 128,525.40	$ 128,525.40	$ 128,525.40	$ 128,525.40	$ 128,525.40	
Active Time Lost Cost	$ 569,682.45	$ 569,682.45	$ 569,682.45	$ 569,682.45	$ 569,682.45	$ 569,682.45	
Total Benefits (Future Value)	$ 1,767,758.85	$ 1,767,758.85	$ 1,767,758.85	$ 1,767,758.85	$ 1,767,758.85	$ 1,767,758.85	
Total Benefits (Present Value)	**$ 1,767,758.85**	**$ 1,636,813.75**	**$ 1,515,568.29**	**$ 1,403,303.97**	**$ 1,299,355.53**	**$ 1,203,106.97**	**$ 8,825,907.35**
Present Value Discout Rate	**8%**						

Cost Benefit Analysis	
Total PV Benefits	$ 8,825,907.35
Total PV Costs	$ 6,537,709.15
NET BENEFIT	**2,288,198.20**

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